11. ARCHITECTURE OF THE INFORMATION SYSTEMS CURRICULUM

Architecturally, IS 2009 is quite different from its predecessors. IS 2002 was largely organized around the concept of a course, and it simply consisted of ten courses without any opportunities to vary the curriculum depending on the local requirements or other contextual factors. The Body of Knowledge included in IS 2002 was largely unchanged from IS'97, and the linkage between the courses in the curriculum and the Body of Knowledge was relatively weak.

Key Concepts

The structural architecture of IS 2009 is informed by the concept structure represented in Figure 4, which illustrates a proposed optimal structure for a computing curriculum. This structure includes three major elements: Course, Learning Objective, and the three-level Knowledge Area – Knowledge Unit – Topic hierarchy that is used also in all other computing curriculum volumes (CS 2008, IT 2008, SE 2004, and CE 2004). The concept of Coverage represents the coverage of a specific Topic within a Course in order to support the achievement of a specific Learning Objective. Please note that Topics themselves can be organized hierarchically into multiple levels. A Level is specified for each Learning Objective, indicating the type of cognitive processing that the student is required to demonstrate in order to achieve the learning objective. A slightly revised version of Bloom's taxonomy described in Appendix 4 of IS 2002 and included in Appendix 3 of this document will be used for the Levels. Fundamentally, the intent is to specify the goal state regarding the students' abilities in relation to a concept/topic: whether the students are required to be aware of a topic, understand it at a deeper level, use the concept in an analysis, or create new concepts or artifacts in the context of a learning outcome.

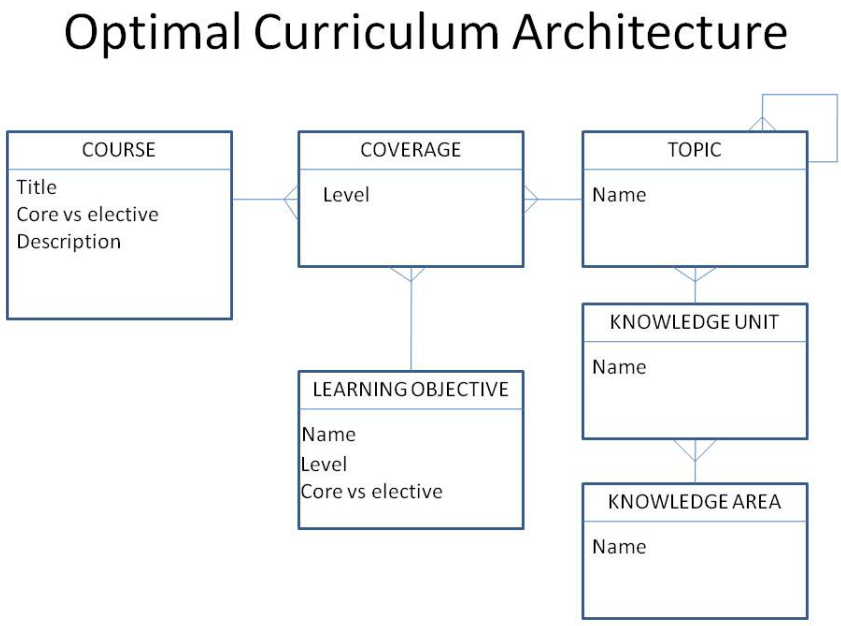

Figure 4: Proposed Optimal Curriculum Architecture

At the current time, the process of organizing IS knowledge is not, however, specified at a sufficiently advanced level to allow us to fully implement the curriculum using the optimal structure described above. Instead, IS 2009 uses a simplified model (see Figure 5) that links the Learning Objectives to Courses and Courses directly to Topics with a many-to-many relationship. The Knowledge Area – Knowledge Unit – Topic hierarchy is used for the first time in an IS model curriculum, which brings this document structurally closer to the other computing curricula. Each Knowledge Area, Knowledge Unit, and Topic is specified as either core or elective. The Level of coverage is specified at the course level.

The Core Information Systems Body of Knowledge is presented in Appendix 4 of this document. This Body of Knowledge organizes the IS curriculum core content into four different Knowledge Area categories: General Computing, IS Specific, Foundational, and Domain-specific. We believe that Information Systems as a discipline can effectively borrow content from other computing disciplines for the General Computing Knowledge Areas and that the content in Foundational and Domain-specific Knowledge Areas is largely determined outside computing. Therefore, the IS discipline will only have to develop and maintain a Body of Knowledge structure for the Knowledge Areas that are truly IS Specific.

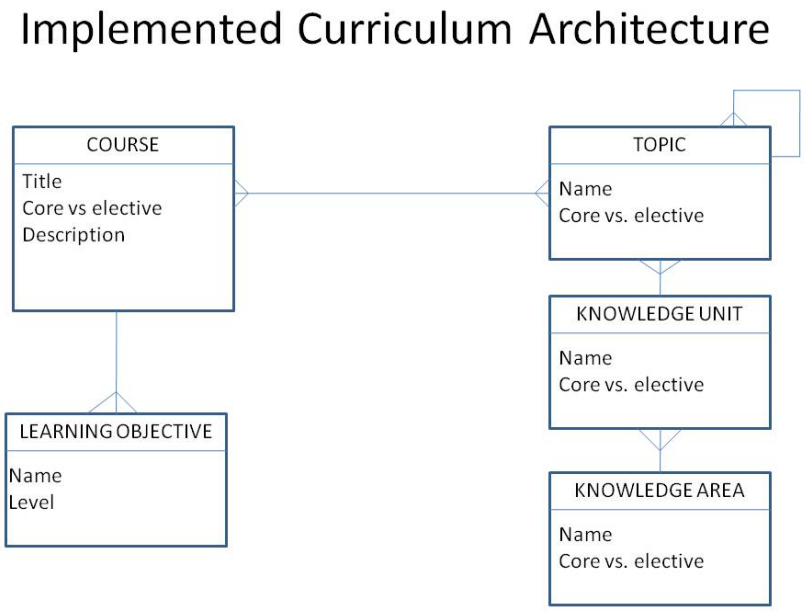

Figure 5: Simplified Curriculum Architecture Model

General Curriculum Structure for Courses focusing on IS Specific Skills and Knowledge

In this section, we discuss the general architecture for the courses that focus on the development of Information Systems specific skills and knowledge. The coverage of content that focuses on the development of Foundational and Domain-specific knowledge and skills is discussed later in the document.

As discussed earlier in this document, IS 2009 introduces a separation between core and elective courses. IS 2009 consists of seven **core courses**, which specify the required knowledge units and topics that have to be covered in every Information Systems program. We acknowledge that the time available to cover the core material and the needs of the program vary depending on the local context. Therefore, the depth and type of coverage of the core topics differ between programs, even though every core topic has to be covered in every Information Systems curriculum. Also, every instance of a Course is not always technically a separate course in the schedule; it is possible that an implemented curriculum may, for example, combine two instances of a Course into one.

In addition, the model curriculum includes examples of **elective courses**, which either expand on the coverage provided by the core course within a specific knowledge area or introduce new knowledge areas to the curriculum. The elective courses are essential building blocks of **career tracks**, which consist of the core and a set of elective courses. The matrix included in Figure 6 includes the core courses and sample electives mapped to a number of suggested career tracks.

Structure of the IS Model Curriculum:Information Systems specific courses [edit]

Career Track:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Core IS Courses:																	
Foundations of IS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Enterprise Architecture	○	●	○	○	○	●	○	○	○	○	●	○	○	○	●	○	○
IS Strategy, Management and Acquisition	○	●	○	○	○	●	○	○	●	○	●	○	○	○	●	○	○
Data and Information Management	●	○	○	●	●	○	○	●	●	○	●	○	●	○	○	○	○
Systems Analysis & Design	●	●	●	○	○	○	○	○	○	○	○	○	○	○	●	●	●
IT Infrastructure	○	○	○	●	○	○	○	●	●	●	○	○	●	●	○	○	○
IT Project Management	●	○	○	○	○	●	○	○	○	○	●	○	○	○	●	●	●
Elective IS Courses:																	
Application Development	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	●
Business Process Management		●	●			○	○	○		○	●				○		
Collaborative Computing						○								○			○
Data Mining / Business Intelligence		●		●	●	○	○	○	●		○	○	○	○	○		○
Enterprise Systems		●	●	○	○	○	●	●	○		●	●	○	○			
Human-Computer Interaction	●					○	○				○					●	
Information Search and Retrieval		○		○	●								○				●
IT Audit and Controls	○		●	○	○	○	○	●		●	○		○	○	○		○
IT Security and Risk Management	○			○	○	○	○	●	●	○	○		●	●	○		○
Knowledge Management		●		○		○	○			○							
Social Informatics													○		○		

A	= Application Developer
B	= Business Analyst
C	= Business Process Analyst
D	= Database Administrator
E	= Database Analyst
F	= e-Business Manager
G	= ERP Specialist
H	= Information Auditing and Compliance Specialist
I	= IT Architect
J	= IT Asset Manager
K	= IT Consultant
L	= IT Operations Manager
M	= IT Security and Risk Manager
N	= Network Administrator
O	= Project Manager
P	= Web Content Manager
Q	= Web Content Manager

Key:

● = Significant Coverage

○ = Some Coverage

Blank Cell = Not Required

Figure 6: Structure of the IS 2009 Model Curriculum

The IS Specific Course Matrix is structured based on career track outcomes. This approach allows a high level of local flexibility and variability while maintaining the core of the discipline. Students undertaking a program's course of study could be preparing for career tracks such as Application Developer, Business Analyst, Business Process Analyst, Database Administrator, and so on. Based on the career track focus of an IS program, recommendations for the relative

importance of core and elective knowledge areas are provided in the IS Specific Course Matrix. Specific course implementations may thereby be tailored to include an emphasis on one or more knowledge areas, forming the required and elective courses, appropriate to the career track outcomes of individual instances of IS programs of study.

Further definition of each of the career tracks is provided on the website blogsandwikis.bentley.edu/is curriculum. Included are a description of the career track, skills necessary to the career track, and coverage level for core and elective topics. Depth of coverage for the topics is specified as significant, some, and no coverage.

The core courses and their recommended sequence are presented in Figure 7 as follows:

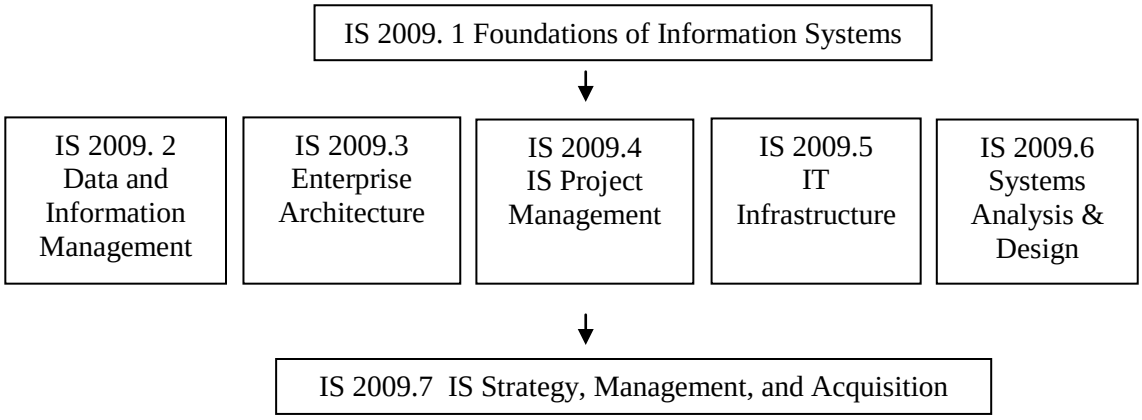

Figure 7: IS 2009 Core Courses

The IS 2009.1 *Foundations of Information Systems* course is a prerequisite for all the other courses, and the IS 2009.7 *IS Strategy, Management, and Acquisition* course is a capstone that should be either the last or one of the last courses that students take.

The elective courses can be offered in the curriculum at any point that fits course-specific prerequisite requirements.

Core Course Changes in IS 2009

There are several major differences between the courses recommended by IS 2002 and the courses proposed in IS 2009. The following will list these major differences while also describing in detail why these changes were implemented by the task force.

1. **Status of Application Development in the curriculum**. One of the more noticeable changes to the IS model curriculum is the removal of application development (IS 2002.5 Programming, Data, File, and Object Structures) from the prescribed core. It is important to understand that although application development is not included in the core, it has not been removed from the IS program, and the task force acknowledges that a strong case can be made for inclusion of programming, computational thinking, data structures, and related material in an IS program (see, for example, (Topi et al. 2008)). In fact, application development can still be offered in most IS programs. By offering application development as an elective the IS 2009 model curriculum increases its reach into non-

business IS programs while also creating flexibility for curricula that choose to include an application development course. In addition, the programs that want to go even further and include a sequence of programming courses can choose from approaches introduced either in the Computer Science or in the Information Technology curriculum volumes (CS 2008 or IT 2008, respectively).

2. **Inclusion of both enterprise architecture and IT infrastructure** – The IS 2002 model curriculum includes both an IT Hardware and System Software course (IS 2002.4) and a Network and Telecommunication course (IS 2002.6) to edify the concepts and practices related to IT infrastructure. The IS 2009 model curriculum proposes a different approach, which integrates the material included in IS 2002 into IS 2009.5 IT Infrastructure course and introduces a new IS 2009.3 Enterprise Architecture course that focuses on concepts at a higher level of abstraction. IT Infrastructure includes computer and systems architecture and communication networks, with an overall focus on the services and capabilities that IT infrastructure solutions provide in an organizational context. Enterprise Architecture focuses on organizational level issues related to planning, architecting, designing, and implementing IT-based solutions that utilize the platform technologies covered in the IT Infrastructure (IS 2009.5) course and the application and data & information management solutions covered in the Systems Analysis & Design (IS 2009.6) and Data and Information Management (IS 2009.2) courses, respectively This course adopts a strongly integrative perspective related to the design and utilization of information and organizational processes across functional areas with a unified system view. IT Infrastructure covers the core technical foundations whereas Enterprise Architecture provides an integrated organizational perspective to planning and designing institutional solutions.

3. **Removal of Personal Productivity Tools Course –** The revised IS 2009 **c**urriculum recommends dropping the course focusing on personal productivity tools from IS programs. The task force has found that typically institutions now require all students to be proficient in personal productivity applications such as word processing, spreadsheets, and presentation software prior to enrolling in any major. Further, most high schools also are preparing students in this area before they reach a higher education environment.

4. **Sequencing –** The IS 2002 model curriculum recommended various levels of sequencing in the curriculum (e.g., Fundamentals of IS is a prerequisite to Analysis and Logical Design, IT Hardware and Systems Software was a prerequisite to Networks and Telecommunications and so on). By flattening the sequencing constellation of the curriculum, IS 2009 offers a flexible structure that can integrate electives easily. Also, the flattened curriculum structure allows students to pass more easily through IS programs avoiding possible sequencing bottlenecks.

Detailed descriptions of the seven core courses and a set of sample electives are included in the last section of this document.

Foundational and Domain-specific Skills and Knowledge

This curriculum recommendation does not provide specific courses that address the outcome expectations related to foundational skills and knowledge or domain-specific skills and knowledge. As specified earlier in the document in the section related to IS program outcome expectations, these two areas are essential for IS graduates and need to be covered in every IS

curriculum in a way that ensures that the high-level outcome expectations are met. Fundamentally, there are two ways to accomplish this: either, the degree programs are offered in an environment (for example, a business school or a school of public policy) in which general curriculum requirements for the school as a whole ensure that these educational objectives are met or the school specifically designs and implements courses that are intended to develop capabilities in these two areas. Without sufficient coverage related to foundational skills and knowledge and to domain-specific skills and knowledge a curriculum is not compatible with this curriculum recommendation, even if we do not specifically articulate how these requirements should be met.

For example, in a typical business school context, the foundational knowledge and skills would be covered in both general education and business core courses, whereas the business core would be used to develop the domain-specific skills and knowledge.

12. RESOURCES FOR IS DEGREE PROGRAMS

The resources for the IS degree programs have changed substantially since the last curriculum revision. Similar to past curriculum revisions a capable faculty is the first required resource (Firth et al. 2008). In addition to faculty the resources needed for an IS degree program are Internet access, laboratories and library resources. In a rapidly changing technical environment, students should be exposed to a variety of up-to-date hardware and software systems that adequately represent the professional setting in which they will be employed.

Faculty Requirements

Faculty members are vital to the strength of an Information Systems program. Its faculty needs both academic training and practical experience (Looney et al. 2007). There must be enough faculty to provide course offerings that allow the students to complete a degree in a timely manner. The interests and qualifications of the faculty must be sufficient not only to teach the courses but also to plan and modify the courses and curriculum.

Faculty members must remain current in the discipline. Professional development and scholarly activities are a joint obligation of the institution and the individual faculty members. The school should support continuing faculty development. Given the rapidly changing technology, it is particularly critical that faculty members have sufficient time for professional development and scholarly activities. Resources should be provided for faculty to regularly attend conferences, workshops, and seminars, and to participate in academic and professional organizations. The program is enhanced significantly when faculty acquire practical experience in the profession through activities such as consulting, sabbatical leaves, and industry exchange programs. Faculty must also be equipped to develop teaching materials for their students. Faculty must have available technology at least equivalent to and compatible with that available to students so that they may prepare educational materials for use by students. In addition, faculty must be connected to the Internet in order to have access to students and to the larger academic and professional community.

The number of full-time faculty needed by the program is influenced by such factors as the number of students in the program, the number of required courses, the number of service and elective courses offered, and the teaching load of the faculty. A program should have a minimum number of full-time faculty with primary commitment to the Information Systems program in order to meet the teaching and advising needs of the program and to provide depth and breadth of